



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2012-0344; Special Conditions No. 25-461-SC]

Special Conditions: Dassault Aviation, Model Falcon 7X Airplanes; Seats with Inflatable Shoulder Straps.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Dassault Aviation Model Falcon 7X airplane. This airplane will have a novel or unusual design feature associated with seats with inflatable shoulder straps. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: The effective date of these special conditions is March 19, 2012. We must receive your comments by **[insert date 45 days after FR publication date]**.

ADDRESSES: Send comments identified by docket number FAA-2012-0344 using any of the following methods:

- Federal eRegulations Portal: Go to <http://www.regulations.gov> and follow the online instructions for sending your comments electronically.

- Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 8 a.m. and 5 p.m., Monday through Friday, except federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at <http://DocketsInfo.dot.gov>.

Docket: Background documents or comments received may be read at <http://www.regulations.gov> at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

FOR FURTHER INFORMATION CONTACT: Dan Jacquet, FAA, Airframe and Cabin Safety Branch, ANM-115, Transport Airplane Directorate, Aircraft Certification Service,

1601 Lind Avenue SW, Renton, Washington 98057-3356; telephone 425-227-2676; facsimile 425-227-1149.

SUPPLEMENTARY INFORMATION:

The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions are impracticable because these procedures would significantly delay issuance of the design approval and thus delivery of the affected aircraft. In addition, the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon issuance.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On March 15, 2011, Dassault Aviation applied for a change to Type Certificate No. A59NM to install an inflatable restraint system on side facing divans in Dassault Aviation Model Falcon 7X airplanes (hereafter referred to as “Falcon 7X”). The Falcon 7X is a 19-passenger, transport category airplane powered by three aft-mounted Pratt & Whitney PW307A high-bypass-ratio turbofan engines. Maximum takeoff weight is 69,000 pounds, and maximum certified altitude is 51,000 feet with a range of 5,700 nautical miles.

The inflatable restraint system is designed to limit occupant forward excursion in the event of an accident. This will reduce the potential for head injury, thereby reducing the Head Injury Criteria (HIC) measurement. The inflatable restraint system behaves similarly to an automotive inflatable airbag, but in this case the airbag is integrated into the shoulder strap and inflates away from the seated occupant. While inflatable airbags are now standard in the automotive industry, the use of an inflatable shoulder strap is novel for commercial aviation.

Title 14, Code of Federal Regulations (14 CFR) 25.785 requires that occupants be protected from head injury by either the elimination of any injurious object within the striking radius of the head, or by padding. Traditionally, this has required a setback of 35 inches from any bulkhead or other rigid interior feature or, where not practical, specified types of padding. The relative effectiveness of these means of injury protection was not quantified. With the adoption of Amendment 25-64 to part 25, specifically § 25.562, a new standard that quantifies required head injury protection was created.

Section 25.562 specifies that each seat type design approved for crew or passenger occupancy during takeoff and landing must successfully complete dynamic tests or be shown to be compliant by rational analysis based on dynamic tests of a similar type seat. In particular, the regulations require that persons not suffer serious head injury under the conditions specified in the tests, and that protection must be provided or the seat be designed so that the head impact does not exceed a HIC of 1000 units. While the test conditions described for HIC are detailed and specific, it is the intent of the requirement that an adequate level of head injury protection be provided for passengers in a severe crash.

Because §§ 25.562 and 25.785 and associated guidance do not adequately address seats with inflatable shoulder straps, the FAA recognizes that appropriate pass/fail criteria need to be developed that do fully address the safety concerns specific to occupants of these seats.

Type Certification Basis

Under the provisions of 14 CFR 21.101, Dassault Aviation must show that the Falcon 7X, as changed, continues to meet the applicable provisions of the regulations incorporated by reference in Type Certificate No. A59NM or the applicable regulations in effect on the date of application for the change. The regulations incorporated by reference in the type certificate are commonly referred to as the “original type certification basis.” The regulations incorporated by reference in Type Certificate No. A59NM are as follows: 14 CFR part 25, effective February 1, 1965, including Amendments 25-1 through 25-111 in entirety, and in accordance with 14 CFR part 11, Special Conditions No. 25-346-SC: High Intensity Radiated Fields (HIRF) Protection.

The U.S. type certification basis for the Falcon 7X is established in accordance with 14 CFR 21.29 and 21.17 and the type certification application date. The U.S. type certification basis is listed in Type Certification Data Sheet No. A59NM.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Falcon 7X because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, the special conditions would also apply to the other model.

In addition to the applicable airworthiness regulations and special conditions, the Falcon 7X must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

Novel or Unusual Design Features

The Falcon 7X will incorporate the following novel or unusual design feature: Dassault Aviation is proposing to install inflatable shoulder straps on side facing divans to reduce the potential for head injury in the event of an accident. The inflatable shoulder strap works similarly to an automotive airbag, except that the airbag is integrated with the shoulder strap of the restraint system.

Part 25 states the performance criteria for head injury protection in objective terms. However, none of these criteria are adequate to address the specific issues raised concerning seats with inflatable shoulder straps. The FAA has therefore determined that, in addition to the requirements of part 25, special conditions are needed to address requirements particular to installation of seats with inflatable shoulder straps.

Accordingly, in addition to the passenger injury criteria specified in § 25.785, these special conditions are adopted for Falcon 7X airplanes equipped with inflatable shoulder straps. Other conditions may be developed, as needed, based on further FAA review and discussions with the manufacturer and civil aviation authorities.

Discussion

From the standpoint of a passenger safety system, the inflatable shoulder strap is unique in that it is both an active and entirely autonomous device. While the automotive industry has good experience with airbags, the conditions of use and reliance on the inflatable shoulder strap as the sole means of injury protection are quite different. In automobile installations, the airbag is a supplemental system and works in conjunction with an upper torso restraint. In addition, the crash event is more definable and of typically shorter duration, which can simplify the activation logic. The airplane operating environment is also quite different from automobiles and includes the potential for greater wear and tear and unanticipated abuse conditions (due to galley loading, passenger baggage, etc.). Airplanes also operate where exposure to high intensity electromagnetic fields could affect the activation system.

The inflatable shoulder strap has two potential advantages over other means of head impact protection. First, it can provide significantly greater protection than would be expected with energy-absorbing pads; and second, it can provide essentially equivalent protection for occupants of all stature. These are significant advantages from a safety standpoint, since such devices will likely provide a level of safety that exceeds the minimum standards of the federal aviation regulations. Conversely, inflatable shoulder straps in general are active systems and must be relied upon to activate properly when needed, as opposed to an energy-absorbing pad or upper torso restraint that is passive and always available. Therefore, the potential advantages must be balanced against this and other potential disadvantages in order to develop standards for this design feature.

The FAA has considered the installation of inflatable shoulder straps to have two primary safety concerns: first, that they perform properly under foreseeable operating conditions, and second, that they do not perform in a manner or at such times as would constitute a hazard to the airplane or occupants. This latter point has the potential to be the more rigorous of the requirements, owing to the active nature of the system.

The inflatable shoulder strap will rely on electronic sensors for signaling and a stored gas canister for inflation. These same devices could be susceptible to inadvertent activation, causing deployment in a potentially unsafe manner. The consequences of inadvertent deployment, as well as failure to deploy, must be considered in establishing the reliability of the system. Dassault Aviation must substantiate that the effects of an inadvertent deployment in flight either would not cause injuries to occupants or that such deployment(s) meet the requirement of § 25.1309(b). The effect of an inadvertent deployment on a passenger or crewmember that might be positioned close to the inflatable shoulder strap should also be considered. The person could be either standing or sitting. A minimum reliability level will have to be established for this case, depending upon the consequences, even if the effect on the airplane is negligible.

The potential for an inadvertent deployment could be increased as a result of conditions in service. The installation must take into account wear and tear so that the likelihood of an inadvertent deployment is not increased to an unacceptable level. In this context, an appropriate inspection interval and self-test capability are considered necessary. Other outside influences are lightning and high intensity radiated fields (HIRF). Existing HIRF special conditions for the Dassault Aviation Model Falcon 7X airplanes, Special Conditions No. 25-346-SC, are applicable. Finally, the inflatable shoulder strap installation should be protected from the effects

of fire, so that an additional hazard is not created by, for example, a rupture of the pyrotechnic squib.

In order to be an effective safety system, the inflatable shoulder strap must function properly and must not introduce any additional hazards to occupants as a result of its functioning. There are several areas where the inflatable shoulder strap differs from traditional occupant protection systems, and requires special conditions to ensure adequate performance.

Because the inflatable shoulder strap is essentially a single use device, there is the potential that it could deploy under crash conditions that are not sufficiently severe as to require head injury protection from the inflatable shoulder strap. Since an actual crash is frequently composed of a series of impacts before the airplane comes to rest, this could render the inflatable shoulder strap useless if a larger impact follows the initial impact. This situation does not exist with energy absorbing pads or upper torso restraints, which tend to provide continuous protection regardless of severity or number of impacts in a crash event. Therefore, the inflatable shoulder strap installation should provide protection, when it is required, by not expending its protection during a less severe impact. Also, it is possible to have several large impact events during the course of a crash, but there is no requirement for the inflatable shoulder strap to provide protection for multiple impacts.

Since each occupant's restraint system provides protection for that occupant only, the installation must address seats that are unoccupied. It will be necessary to show that the required protection is provided for each occupant regardless of the number of occupied seats, and considering that unoccupied seats may have shoulder straps that are active.

The inflatable shoulder straps should be effective for a wide range of occupants. The FAA has historically considered the range from the fifth percentile female to the ninety-fifth percentile male as the range of occupants that must be taken into account. In this case, the FAA is proposing consideration of a broader range of occupants, due to the nature of the shoulder straps installation and its close proximity to the occupant. In a similar vein, these persons could have assumed the brace position, for those accidents where an impact is anticipated. Test data indicate that occupants in the brace position do not require supplemental protection, and so it would not be necessary to show that the inflatable shoulder straps will enhance the brace position. However, the inflatable shoulder straps must not introduce a hazard in the case of deploying into the seated, braced occupant.

Another area of concern is the use of seats, so equipped, by children whether lap-held, in approved child safety seats, or occupying the seat directly. Similarly, if the seat is occupied by a pregnant woman, the installation should address such usage, either by demonstrating that it will function properly, or by adding appropriate limitation on usage.

Since the inflatable shoulder strap will be electrically powered, there is the possibility that the system could fail due to a separation in the fuselage. Since this system is intended as crash/post-crash protection means, failure to deploy due to fuselage separation is not acceptable. As with emergency lighting, the system should function properly if such a separation occurs at any point in the fuselage.

Since the inflatable shoulder strap is likely to have a large volume displacement, the inflated bag could potentially impede egress of passengers. Since the bag deflates to absorb energy, it is likely that an inflatable shoulder strap would be deflated at the time that persons

would be trying to leave their seats. Nonetheless, it is considered appropriate to specify a time interval after which the inflatable shoulder strap may not impede rapid egress. Ten seconds has been chosen as a reasonable time, since this corresponds to the maximum time allowed for an exit to be openable (§ 25.809). In actuality, it is unlikely that an exit would be prepared by a flight attendant this quickly in an accident severe enough to warrant deployment of the inflatable shoulder strap, and the inflatable shoulder strap is expected to deflate much quicker than ten seconds.

Part I of appendix F to part 25 specifies the flammability requirements for interior materials and components. There is no reference to inflatable restraint systems in appendix F, because such devices did not exist at the time the flammability requirements were written. The existing requirements are based on both material types, as well as use, and have been specified in light of the state-of-the-art of materials available to perform a given function. In the absence of a specific reference, the default requirement would be for the type of material used to construct the inflatable restraint, which is a fabric in this case. However, in writing special conditions, the FAA must also consider the use of the material, and whether the default requirement is appropriate. In this case, the specialized function of the inflatable shoulder strap means that highly specialized materials are needed. The standard normally applied to fabrics is a 12-second vertical ignition test. However, materials that meet this standard do not perform adequately as inflatable shoulder straps. Since the safety benefit of the inflatable shoulder strap is significant, the flammability standard appropriate for these devices should not screen out suitable materials, thereby effectively eliminating use of inflatable shoulder straps. The FAA will need to establish a balance between the safety benefit of the inflatable shoulder strap and its flammability

performance. At this time, the 2.5-inch per minute horizontal test is considered to provide that balance. As the technology in materials progresses (which is expected), the FAA may change this standard in subsequent special conditions to account for improved materials.

The following special conditions can be characterized as addressing either the safety performance of the system or the system's integrity against inadvertent activation. Because a crash requiring use of the inflatable shoulder strap is a relatively rare event, and because the consequences of an inadvertent activation are potentially quite severe, these latter requirements are probably the more rigorous from a design standpoint.

Finally, it should be noted that these special conditions are applicable to the inflatable shoulder straps as installed. These special conditions are not an installation approval. Therefore, while these special conditions relate to each such system installed, the overall installation approval is a separate finding and must consider the combined effects of all such systems installed.

Applicability

As discussed above, these special conditions are applicable to the Dassault Aviation Model Falcon 7X. Should Dassault Aviation apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on one model of airplanes. It is not a rule of general applicability.

The substance of these special conditions has been subjected to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, because a delay would significantly affect the certification of the airplane, which is imminent, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions upon issuance. The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Dassault Aviation Model Falcon 7X airplanes.

1. Seats with Inflatable Shoulder Straps. It must be shown that the airbag system in the shoulder strap will deploy and provide protection under crash conditions where it is necessary to prevent serious injury. The means of protection must take into consideration a range of stature from a two-year-old child to a ninety-fifth percentile male. The airbag system in the shoulder strap

must provide a consistent approach to energy absorption throughout that range of occupants. In addition, the following situations must be considered:

- a. The seat occupant is holding an infant.
 - b. The seat occupant is a child in a child restraint device.
 - c. The seat occupant is a child not using a child restraint device.
 - d. The seat occupant is a pregnant woman.
2. The airbag system in the shoulder strap must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly, considering that unoccupied seats may have an active airbag system in the shoulder strap.
3. The design must prevent the airbag system in the shoulder strap from being either incorrectly buckled or incorrectly installed, such that the airbag system in the shoulder strap would not properly deploy. Alternatively, it must be shown that such deployment is not hazardous to the occupant and will provide the required injury protection.
4. It must be shown that the airbag system in the shoulder strap is not susceptible to inadvertent deployment as a result of wear and tear or inertial loads resulting from in-flight or ground maneuvers (including gusts and hard landings) and other operating and environmental conditions (vibrations, moisture, etc.) likely to be experienced in service.
5. Deployment of the airbag system in the shoulder strap must not introduce injury mechanisms to the seated occupant or result in injuries that could impede rapid egress. This assessment should include an occupant whose belt is loosely fastened.

6. It must be shown that inadvertent deployment of the airbag system in the shoulder strap, during the most critical part of the flight, will either meet the requirement of § 25.1309(b) or not cause a hazard to the airplane or its occupants.
7. It must be shown that the airbag system in the shoulder strap will not impede rapid egress of occupants 10 seconds after airbag deployment.
8. The airbag system must be protected from lightning and HIRF. The threats to the airplane specified in existing regulations regarding lightning, § 25.1316, and special conditions regarding HIRF, Special Condition No. 25-346-SC, are incorporated by reference for the purpose of measuring lightning and HIRF protection. For the purposes of complying with HIRF requirements, the airbag system in the shoulder strap is considered a "critical system" if its deployment could have a hazardous effect on the airplane; otherwise, it is considered an "essential" system.
9. The airbag system in the shoulder strap must function properly after loss of normal aircraft electrical power and after a transverse separation of the fuselage at the most critical location. A separation at the location of the airbag system in the shoulder strap does not have to be considered.
10. It must be shown that the airbag system in the shoulder strap will not release hazardous quantities of gas or particulate matter into the cabin.
11. The airbag system in the shoulder strap installation must be protected from the effects of fire such that no hazard to occupants will result.
12. There must be a means for a crewmember to verify the integrity of the airbag system in the shoulder strap activation system prior to each flight, or it must be demonstrated to reliably

operate between inspection intervals. The FAA considers the loss of the airbag-system deployment function alone (i.e., independent of the conditional event that requires the airbag system deployment) to be a major failure condition.

13. With regard to § 25.853, the inflatable material may not have an average burn rate of greater than 2.5 inches/minute when tested using the horizontal flammability test defined in part 25, appendix F, part I, paragraph (b)(5).

14. The airbag system in the shoulder strap, once deployed, must not adversely affect the emergency-lighting system (i.e., block floor proximity lights to the extent that the lights no longer meet their intended function).

Issued in Renton, Washington, on March 19, 2012.

Ali Bahrami
Manager, Transport Airplane Directorate
Aircraft Certification Service

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